Mirror Lake and Sadony Bayou Habitat, Wildlife, and Macroinvertebrate Survey Report

Spring and Fall - 2021

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Background

Mirror Lake and Sadony Bayou areas have been historically impacted by contaminants as a result of previous industrial activity in these areas. Mirror Lake in particular has been noticeably impacted by a lime pile to the north. Lime has leached into the lake, changing both the chemical and physical properties of the lake. To assess the health and quality of both areas and discern any potential impacts from contamination on the habitat for wildlife, the Muskegon Conservation District conducted bird and amphibian monitoring, at Mirror Lake and Sadony Bayou, along with macroinvertebrate monitoring at Mirror Lake to assess overall habitat and water quality. The results recorded are the complete data set from the spring and fall surveys.

Part 1. Mirror Lake Chemical Analysis

Baseline water quality sampling was completed prior to surveys to ensure safety for employees during sample collection. A grab sample was collected 5/26/2021 and sent to Trace Analytical for analysis. The sample was analyzed for Volatile Organic Compounds (VOC) by GC-MS presence. The results showed no parameters out of the recommended limits. The report is attached in the Appendix.

Part 2. Macroinvertebrate Sampling – Spring and Fall

Benthic macroinvertebrates are useful indicators of ecological integrity. Due to the fact that many macroinvertebrates are relatively immobile and have relatively long-life cycles, the structure and function of the macroinvertebrate community within a lake is a response to exposure of present of past conditions. Thus, sampling the macroinvertebrate communities in the littoral zone of mirror Lake should provide a good indicator of lake quality (EPA National Lakes Assessment, 2012, p. 3). In pursuing this end, the Muskegon Conservation District conducted surveys of two sites in Mirror Lake to study the benthic macroinvertebrate colonization, habitat, and integrity of the site. A spring sampling was completed and followed by a fall sampling for comparison and a seasonally diverse sample. In collecting and analyzing the sample, MCD was unable to use EGLE protocols, as EGLE does not have biological lake sampling protocols currently in use or on file. After some investigation into the reason for this, MCD determined that this is because it is easier to use water chemistry measurements and other parameters to assess lakes as compared to streams, due to the static nature of lake systems and easier sampling access. Despite the lack of formal protocol for inland lake sampling, MCD staff amended the protocol for wadable rivers and streams and applied it to this location. Thus, our employees we were able to collect a repeatable sample, allowing for further analysis of the data, giving indicators of habitat quality. EGLE protocols for streams and rivers have been extrapolated where possible to draw tentative conclusions about the ecological integrity of the site.

Site 1. Mirror Lake – South

Coordinates: 43°22'57.50"N, 86°23'54.11"W

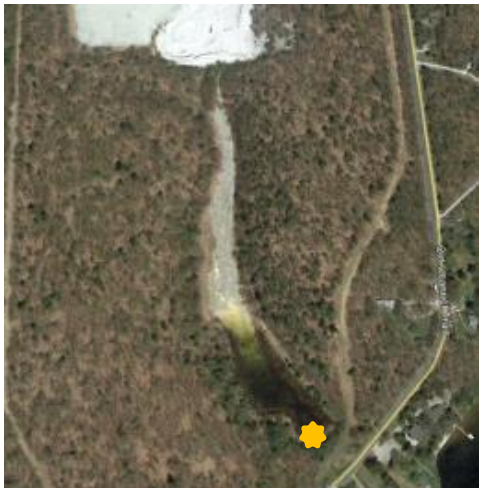

Figure 1. Mirror Lake South Sampling Site

Conditions at time of spring sample- Spring sampling took place 6/18/21 at 11:55 AM, completed by MCD employees Kathryn Pfister and Emily Grasch. Rain had occurred within the last 7 days and the weather conditions were cloudy and the temperature was approximately 70° F.

Conditions at time of fall sample- Fall sampling took place 9/07/21 at 10:40 AM, completed by MCD employees Connor Graebner and Andrew Swayne. Rain had occurred within the last 7 days and the weather conditions were cloudy and the temperature was approximately 72° F.

Habitat description – Mirror Lake is a shallow lake/pond, created and influenced by water table fluctuations. The lake is 1-4 ft deep and 300 ft wide on average based on shoreline observations. The watershed features surrounding the lake are predominantly forest, industrial, and residential. Obvious sources of pollution include the lime pile to the north of the lake, which has heavily impacted the lake water quality, habitat, and morphology. Approximately 10% of the lake is shaded by surrounding trees, and vegetation present at this site includes rooted submergent, rooted floating, root mats, and floating and attached algae. At this site, the water turbidity was clear on the day of observation. No surface oils were observed, and there was a faint methane odor (typical of swamp/marshes decaying organic matter). The benthic habitat included submerged decomposing leaves, sticks and other vegetation on a substrate of sands silts and clays. Large woody debris were present along with standing dead conifers around the sampling area (Figure 1).

In-field macroinvertebrate habitat quality assessment – Epifaunal substrate and available cover was scored “Good” as there is a mix of habitat well suited for full colonization potential and maintenance of populations. The surrounding vegetative protection was scored as “Excellent” as more than 90% of the shoreline surfaces and immediate riparian zone were covered by vegetation (although invasive honeysuckle was observed). The shoreline was also observed to be stable with little potential for future erosion.

Organisms Collected - Spring – In this sample, there were 13 different taxa within 9 orders, and 190 individuals counted (*this does not include any taxa that reached over 100 within the sample as counting was capped at 100 for each taxon) (Figure 2). The dominant species was Notonectidae of order Hemiptera, a species also known as backswimmers. This accounted for 52% of species sampled. Second highest taxon was Hydracarina (or water mites) of order Arachnoidea at 14% dominance. 4 tadpoles were also collected and released onsite during sampling.

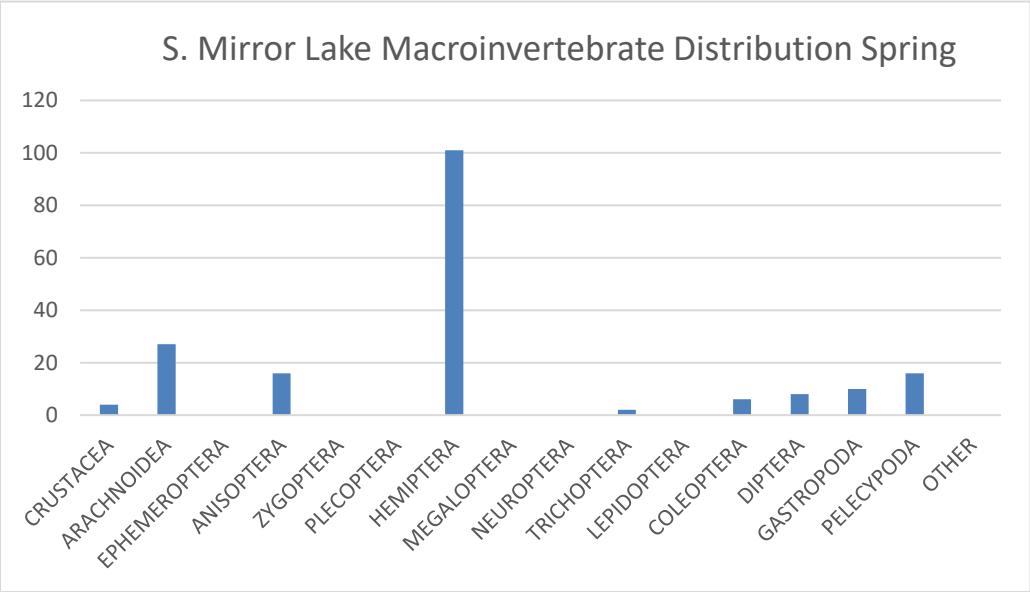

Figure 2. Graphic showing spring macroinvertebrate data from the south sampling location

Organisms Collected – Fall - In this sample, there were 11 different taxa within 8 orders, and 70

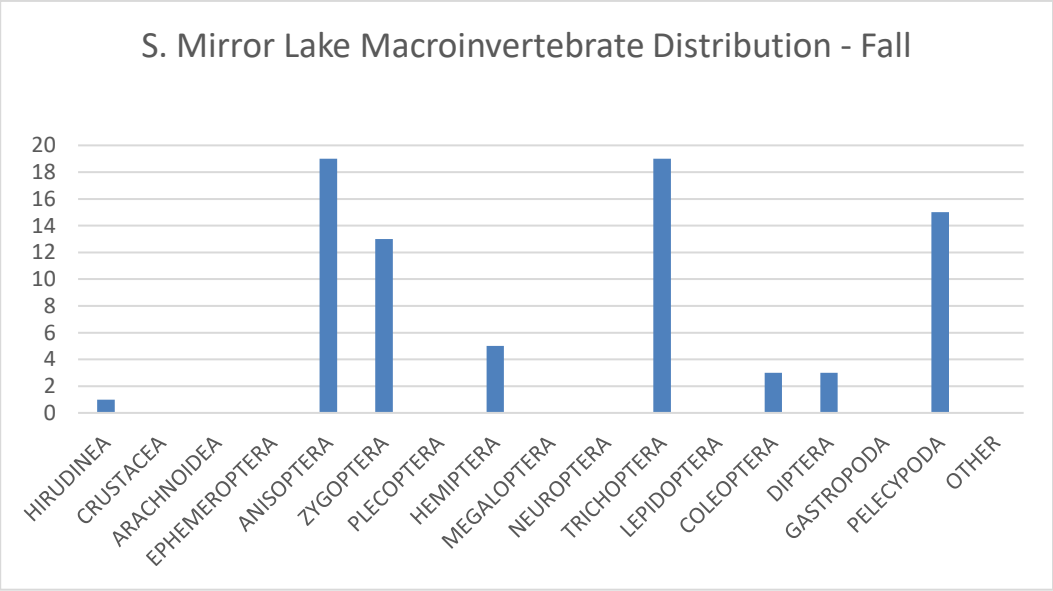

Figure 3. Graphic showing fall macroinvertebrate data from the south sampling location

individuals counted (Figure 3). The dominant species was a tie between an equal number of Libellulidae (skimmers) and Leptoceridae (long-horned caddisflies) of orders Anisoptera and Trichoptera respectively. These two species accounted for 48% of species sampled. The third highest taxon was Lestidae (or spread-winged damselflies) of order Zygoptera at 14% dominance.

Fall and Spring Species Comparison - There are several factors that influence temporal variability in species richness and overall population. Differences between fall and spring results appear significantly different for this location (Figure 4.). The variability can be accounted for by several factors including life cycle, water level fluctuations, water temperature, and predator presence among others. Thus, the differences noted between spring and fall samples at each site is not surprising, and the combination of data from both sampling times serves to contribute to a more robust sample.

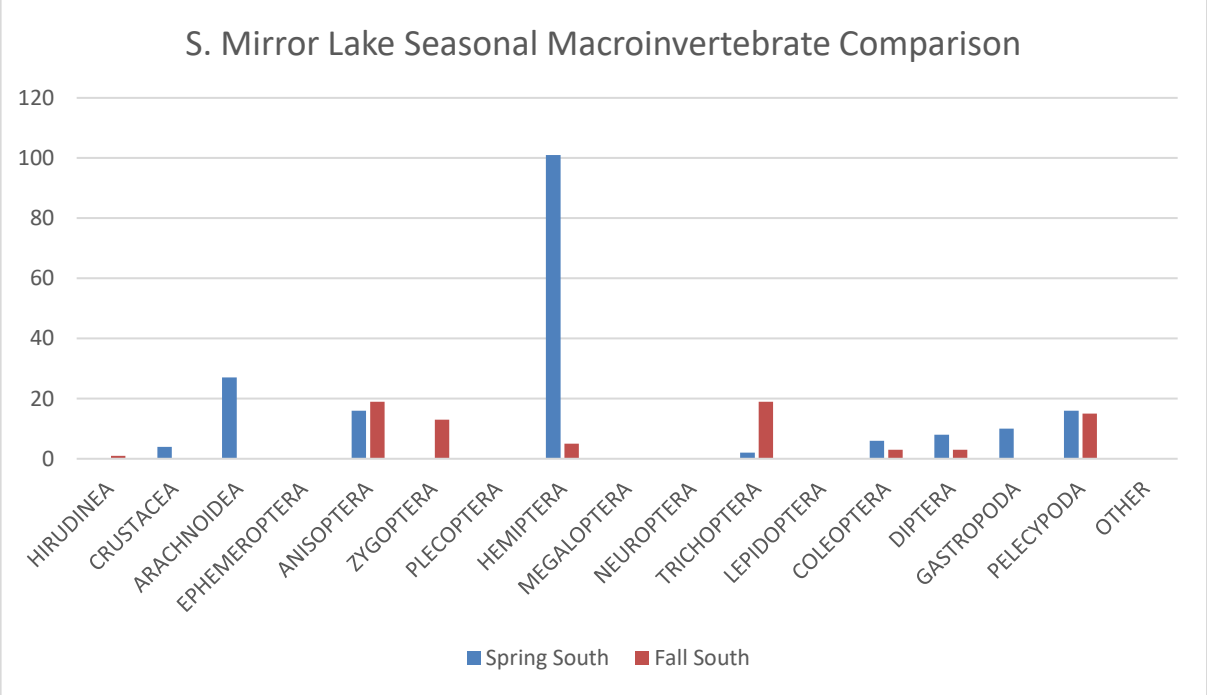

Figure 4. Graphic comparing macroinvertebrate data between spring and fall at the south sampling location.

Site 2. Mirror Lake – North

Coordinates: 43°23'2.08"N, 86°23'58.29"W

Figure 5. Mirror Lake North Sampling Site.

Conditions at time of spring sample- Spring sampling took place 6/18/21 at 1:30 PM, completed by Kathryn Pfister and Emily Grasch. Rain had occurred within the last 7 days and the weather conditions were sunny and clear and the temperature was approximately 75° F.

Conditions at time of fall sample- Fall sampling took place 9/07/21 at 10:40 AM, completed by Connor Graebner and Andrew Swayne. Rain had occurred within the last 7 days and the weather conditions were cloudy and the temperature was approximately 72° F.

Habitat description – Mirror Lake is a shallow lake/pond, created and influenced by water table fluctuations. The lake is 1-4 ft deep and 300 ft wide on average based on shoreline observations. The watershed features surrounding the lake are predominantly forest, industrial, and residential. Obvious sources of pollution include the lime pile to the north of the lake, which has heavily impacted the lake water quality, habitat, and morphology. Approximately 10% of the lake is shaded by surrounding trees, and at the north site there was minimal aquatic vegetation. At this site, the water turbidity was clear on the day of observation. No surface oils were observed, and there was a faint methane odor (typical of swamp/marshes decaying organic matter). Notable about this site was the lime deposits that dominated the benthic substrate. Close to shore there were some submerged decomposing leaves, sticks and other vegetation and silt and sand sediments. Visibility at this site was higher than at the south sampling location, and macroinvertebrates were easily observed in contrast to the lighter substrate. Large woody debris were present around the sampling area (Figure 5).

In-field macroinvertebrate habitat quality assessment – Epifaunal substrate and available cover was scored “Poor” as less than 10% of this site was stable habitat that could be easily colonized. The lime deposits were the primary habitat. The lime deposits significantly impair the substrate, reducing the

available habitat for macroinvertebrates. The surrounding vegetative protection was scored as "Excellent" as more than 90% of the shoreline surfaces and immediate riparian zone were covered by vegetation (although invasive honeysuckle was observed). The shoreline was also observed to be stable with little potential for future erosion.

Organisms Collected - Spring – In this sample, there were 13 different taxa within 8 orders, and 202 individuals counted. The dominant species was Notonectidae of order Hemiptera, a species also known as backswimmers. This accounted for 39% of species sampled. Second highest taxon was Physidae (or bladder snails) of order Gastropoda at 15% dominance. 14 tadpoles were also collected and released onsite during sampling (Figure 6).

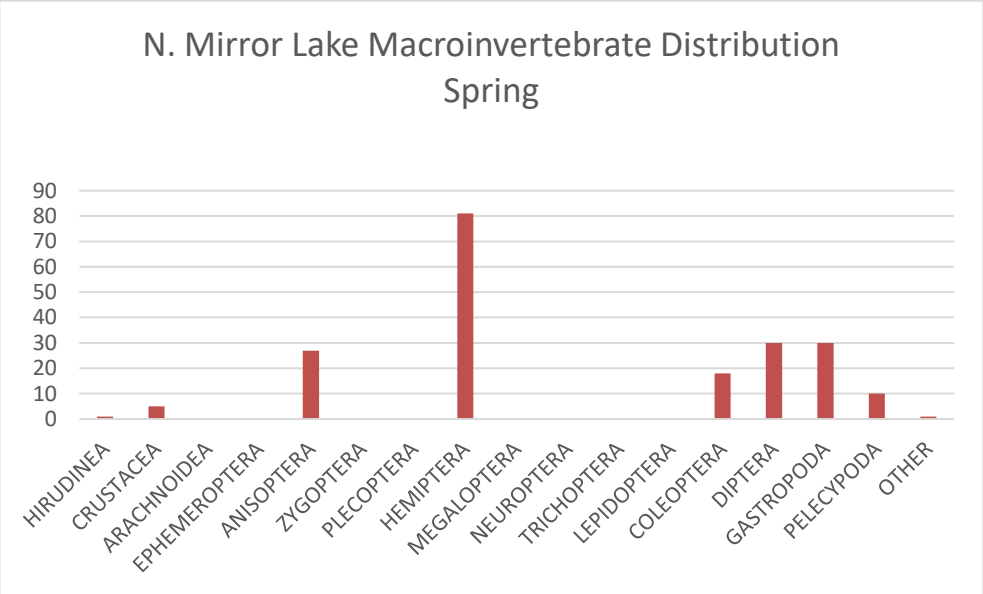

Figure 6. Graphic showing spring macroinvertebrate data from the north sampling location

Organisms Collected - Fall – In this sample, there were 11 different taxa within 9 orders, and 70 individuals counted. The dominant species was Libellulidae of order Anisoptera, a species also known as skimmers. This accounted for 36% of species sampled. The second highest taxon was Hirudinea (leeches) of order Annelida at 22% dominance (Figure 7. below).

Spring and Fall Comparison - There are several factors that influence temporal variability in species richness and overall population. Differences between fall and spring results appear significantly different for this location (Figure 8. below). The variability can be accounted for by several factors including life cycle, water level fluctuations, water temperature, and predator presence among others. Thus, the differences noted between spring and fall samples at each site is not surprising, and the combination of data from both sampling times serves to contribute to a more robust sample.

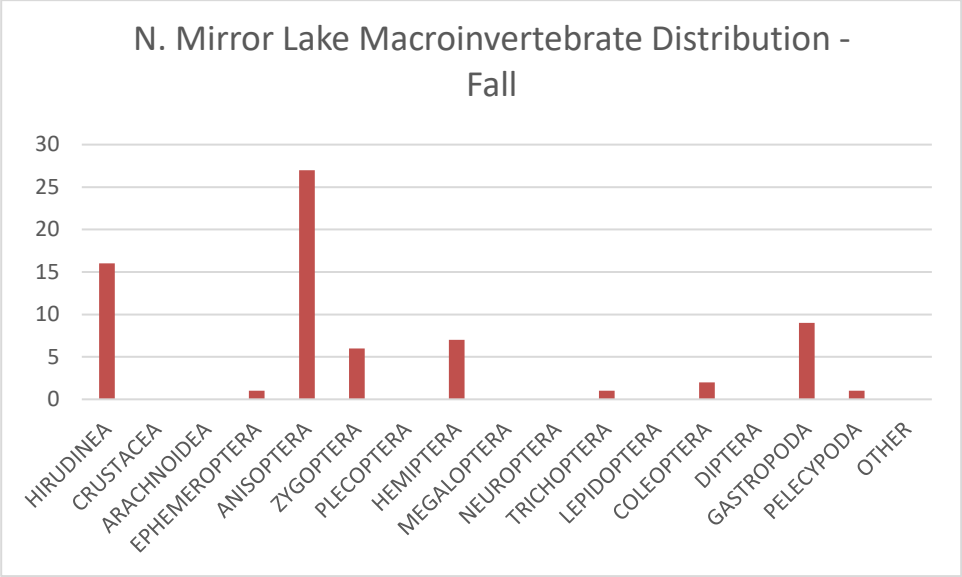

Figure 7. Graphic showing fall macroinvertebrate data from the north sampling location

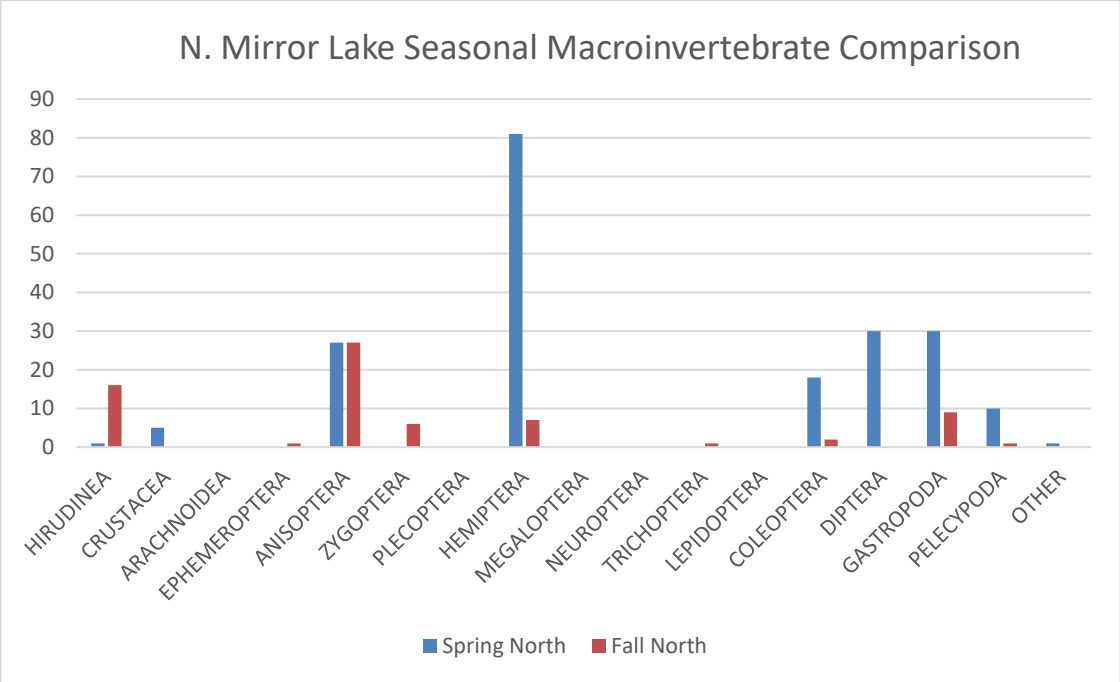

Figure 8. Graphic showing comparison of spring and fall macroinvertebrate data from the north sampling location

Site Comparison and Cumulative Results:

The results from both sites and both survey times showed a result of 13 different orders and 541 individuals in total (Figure 9). Based on extrapolation from EGLE stream quality data indicators, the diversity of taxa seems to suggest "fair" habitat quality. However, while the macroinvertebrate community in Mirror Lake is composed of several taxa, the results do appear to be dominated by relatively few taxa, indicating environmental stress. In addition, high percentages of isopods, snails and leeches can be an indicator of the severity of environmental perturbation present. According to the GLEAS Procedure 51, these species show a high tolerance to physical or chemical parameters, so their presence in higher numbers suggests habitat or chemical impairments (p. 17). This appears to be particularly relevant for the north sampling site, as these taxa account for 20% of the individuals sampled there, whereas the south sampling site only contained 4% of these species.

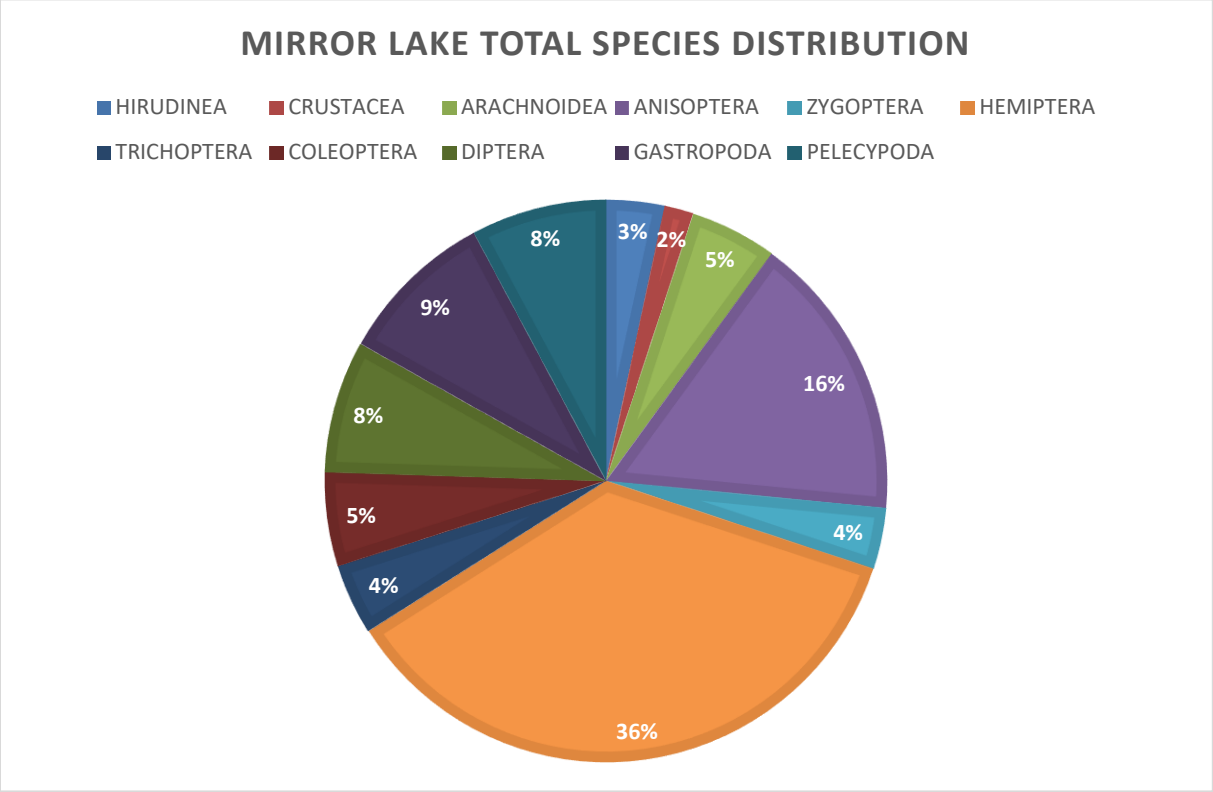

Figure 9. Graphic showing species distribution within Mirror Lake by percentage (species with less than 1% dominance were excluded from the graphic).

The habitat at the south site was higher quality (based on visual assessment), and there may have been a sampling bias due to the higher contrast and visibility of individuals or lack of in-water cover at the north site due to the lime contamination deposits (Figure 10). This is suggested by the results showing that the total number of individuals and taxa collected at the north site appears to be slightly higher at the north location. However, differences in the total number of individuals are not certain since counting is capped at 100 individuals for each taxon, and the limit was met for Notonectidae at the south site but not the north site during spring surveys. It is clear that the structural changes from lime inundation to the substrate at the north site have had a significant negative impact on the macroinvertebrate habitat quality, and the species present seem to reflect this.

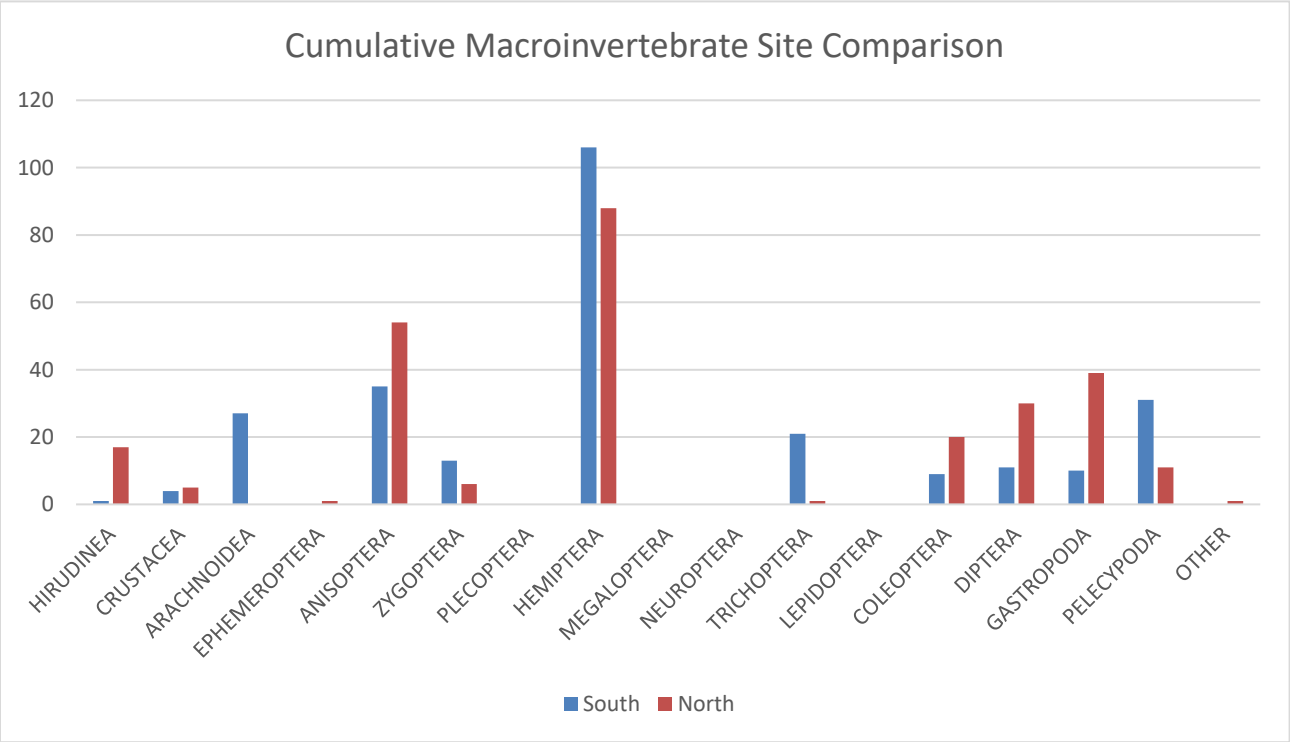

Figure 10. Graphic showing comparative macroinvertebrate quantity and species

Due to the lack of comparative lake macroinvertebrate data, MCD recommends that future quality assessments also include parameters such as: water transparency, total phosphorus, chlorophyll, dissolved oxygen/temperature profiles, zooplankton, and macrophyte quality.

Part 3. Birds and Amphibian Surveys. Bird and Amphibian data was collected using the methodology from the Birds Canada Marsh Monitoring program. The sites were visited twice to survey birds, and three times to survey for amphibians. The visits are timed to maximize chances of detecting as many species as possible. During amphibian surveys, staff listened for a set amount of time and recorded species and numbers of individuals heard. Staff broadcasted calls during the bird surveys to entice secretive marsh species to reveal their presence by responding vocally and observed aerial foragers and fly-through species throughout a 15-minute survey period.

Mirror Lake Site Information – Survey site is located at the south end of the lake facing Northeast. The coordinates are the same as those for the south macroinvertebrate sampling site above (**43°22'57.50"N, 86°23'54.11"W**). The habitat within a 100-meter radius is composed of 40% large patches of open water/floating plants, 20% exposed mud, 20% trees, and 20% shrubs (Figure 11). The site is a permanent medium sized wetland with slight floating plant cover in open water zones, and adjacent human influences include roadside, and industrial impacts to the north.

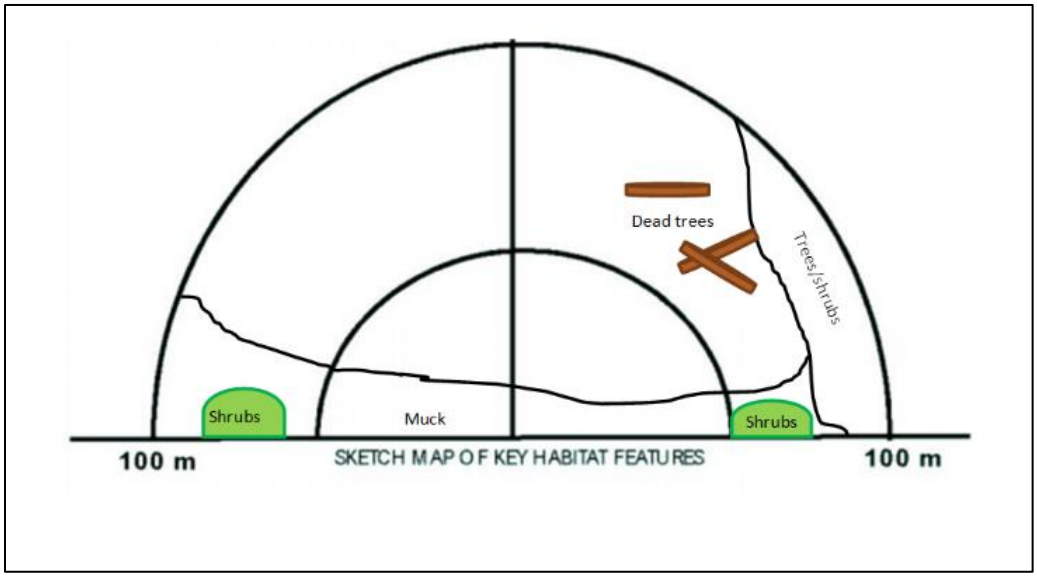

Figure 11. Graphic showing recorded habitat diagram at the Mirror Lake site.

Birds Visit 1. - June 11, 2021. Birds observed at this site were Virginia Rail, Purple Martin, Great Blue Heron, Mallard, Wood Duck, Red-Winged Black Bird, Black Tern, and Song Sparrow. This included eight individuals. The Virginia Rail was observed using audio callback recordings.

Birds Visit 2. – June 25, 2021. Birds observed at this site were Purple Martin, Mallard, Wood Duck, Red-Winged Black Bird, Black Tern, and Song Sparrow. This included eleven individuals and a Mallard family group.

Amphibians Visit 1. May 21, 2021. Amphibians observed at this site included Spring Peepers too numerous to count individuals, and 1 Wood Frog within the survey area.

Amphibians Visit 2. June 11, 2021. Amphibians observed at this site included Spring Peepers too numerous to count individuals, and 1 Pickerel Frog within the survey area. Outside the survey area, Green Frog and Wood Frogs were observed.

Amphibians Visit 3. June 25, 2021. Amphibians observed at this site included Spring Peepers, Green Frogs and at least one Gray Treefrog outside of the survey area.

Sadony Bayou Site Information – Survey site is located at the south side of the bayou along the midpoint of Sadony Rd, facing NNW, and the coordinates are **43°23'6.21"N, 86°25'32.04"W**. The habitat within a 100-meter radius is composed of 70% large patches of open water/floating plants, 5% exposed mud, 20% trees, and 5% herbaceous emergent vegetation cover (mostly cattails)(Figure 12). The site is a permanent large sized wetland complex with slight floating plant cover in open water zones, and adjacent human influences include roadside and residential.

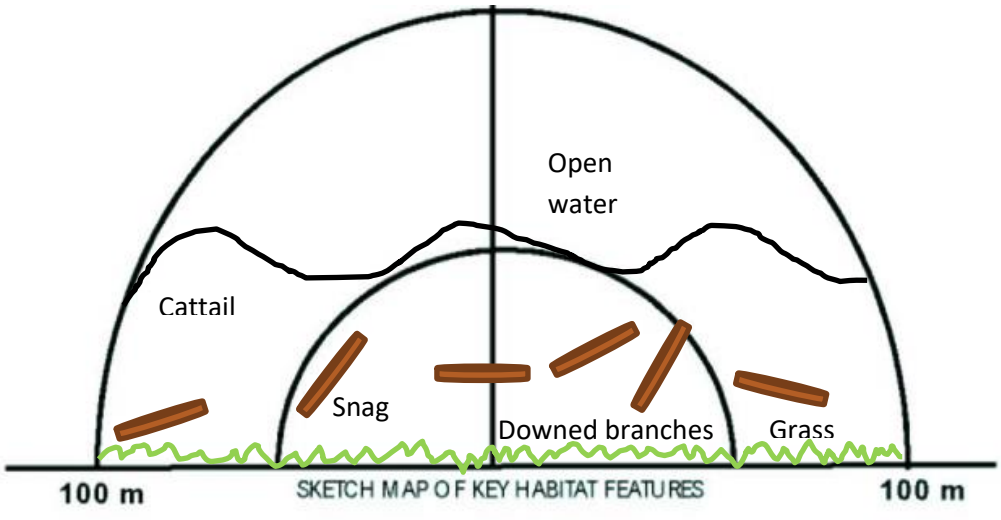

Figure 12. Graphic showing recorded habitat diagram at the Mirror Lake site.

Birds Visit 1. June 11, 2021. Birds observed at this site were Pied-Billed Grebe, Red-Winged Blackbird, Rock Pigeon, Great Blue Heron, Song Sparrow, Swamp Sparrow, and Eastern Kingbird. This included seven individuals. The Pied-billed Grebe was observed using audio callback recordings.

Birds Visit 2. – June 25, 2021. Birds observed at this site were Virginia Rail, Red-Winged Blackbird, Mourning Dove, Black Tern, Belted Kingfisher, Caspian Tern, Wilsons Snipe, Song Sparrow, and Yellow Warbler. This included eleven individuals. The Virginia Rail was observed using audio call back recordings.

Amphibians Visit 1. May 21, 2021. Amphibians observed at this site included 10 Spring Peepers simultaneously calling, and 3 Wood Frogs within the survey area.

Amphibians Visit 2. June 11, 2021. Amphibians observed at this site included 2 Fowler's Toads and 2 Green Frogs outside the survey area.

Amphibians Visit 3. June 25, 2021. Amphibians observed at this site included 1 Spring Peeper and 1 Green Frog outside the survey area.

Summary and Conclusions. Results from both bird and amphibian surveys in 2021 serve to form a baseline for the future five years of survey. Once this data is compiled, trends may be observed in species distribution across the years, and further comparative analysis will be requested from Birds Canada regarding determining relative quality compared with other sites in the Great Lakes

References

Marsh Monitoring Program Participants Handbook for Surveying Marsh Birds. 2009 Edition. 17 pages. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.

Michigan Department of Environmental Quality, Surface Water Quality Division. 1997. *GLEASE Procedure #51 Survey Protocols for Wadable Rivers*. Chapter 25A in Schneider, James C. (ed) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

USEPA. 2017. National Lakes Assessment 2017. *Field Operations Manual*. EPA 841-B-16-002. U.S. Environmental Protection Agency, Washington, DC.

Appendix - Trace Analytical Sampling Results, Mirror Lake 5/25/21